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RC4136

General Performance Quad 741 Operational Amplifier

Features

- Unity gain bandwidth – 3 MHz
- Short circuit protection
- No frequency compensation required
- No latch-up
- Large common mode and differential voltage ranges
- Low power consumption
- Parameter tracking over temperature range
- Gain and phase match between amplifiers

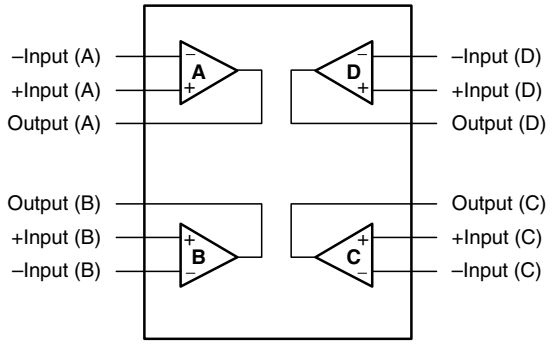
Description

The RC4136 is made up of four 741 type independent high gain operational amplifiers internally compensated and constructed on a single silicon chip using the planar epitaxial process.

This amplifier meets or exceeds all specifications for 741 type amplifiers. Excellent channel separation allows the use of the RC4136 quad amplifier in all 741 operational amplifier applications providing the highest possible packaging density.

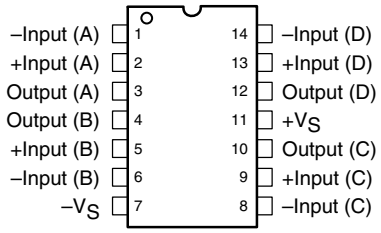
The specially designed low noise input transistors allow the RC4136 to be used in low noise signal processing applications such as audio preamplifiers and signal conditioners.

Block Diagram



65-4136-01

Pin Assignments



65-4136-02

Absolute Maximum Ratings

(beyond which the device may be damaged)[1]

Parameter		Min	Typ	Max	Units
Supply Voltage	RC4136			±18	V
Input Voltage[2]				±30	V
Differential Input Voltage				30	V
Output Short Circuit Duration[3]		Indefinite			
$P_D T_A$ < 50°C	SOIC			300	mW
	PDIP			468	mW
Operating Temperature	RC4136	0		70	°C
Storage Temperature		-65		150	°C
Junction Temperature	SOIC, PDIP			125	°C
Lead Soldering Temperature (60 seconds)	DIP			300	°C
	SOIC			260	°C

Notes:

1. Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if Operating Conditions are not exceeded.
2. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
3. Short circuit may be to ground, typically 45 mA.

Operating Conditions

Parameter			Min	Typ	Max	Units
θ_{JC}	Thermal resistance			60		°C/W
θ_{JA}	Thermal resistance	SOIC		200		°C/W
		PDIP		160		°C/W
For T_A > 50°C Derate at		SOIC		5.0		mW/°C

Electrical Characteristics

(V_S = ±15V and T_A = +25˚C, unless otherwise noted)

Parameters	Test Conditions	RC4136			Units
		Min	Typ	Max	
Input Offset Voltage	$R_S \leq 10k\Omega$		0.5	6.0	mV
Input Offset Current			5.0	200	nA
Input Bias Current			40	500	nA
Input Resistance		0.3	5.0		MΩ
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, V_{OUT} = ±10V	20	300		V/mV
Output Voltage Swing	$R_L \geq 10k\Omega$	±12	±14		V
	$R_L \geq 2k\Omega$	±10	±13		
Input Voltage Range		±12	±14		V
Common Mode Rejection Ratio	$R_S \leq 10k\Omega$	70	100		dB
Power Supply Rejection Ratio	$R_S \leq 10k\Omega$	76	100		dB
Power Consumption	$R_L = \infty$, All Outputs		210	340	mW
Transient Response					
Rise Time	V_{IN} = 20mV, R_L = 2kΩ		0.13		µS
Overshoot	$C_L \leq 100pF$		5.0		%
Unity Gain Bandwidth			3.0		MHz
Slew Rate	$R_L \geq 2k\Omega$		1.0		V/µS
Channel Separation	F = 1.0kHz, R_S =1kΩ		90		dB

Electrical Characteristics

(RC = 0°C ≤ T_A ≤ = 70°, V_S = ± 15V)

Parameters	Test Conditions	RC4136			Units
		Min	Typ	Max	
Input Offset Voltage	$R_S \leq 10k\Omega$			7.5	mV
Input Offset Current				300	nA
Input Bias Current				800	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, V_{OUT} = ±10V	15			V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10			V
Power Consumption			240	400	mW

Electrical Characteristics Comparison

(V_S = ±15V and T_A +25˚C unless otherwise noted)

Parameter	RC4136 (Typ.)	RC741 (Typ.)	LM324 (Typ.)	Units
Input Offset Voltage	0.5	2.0	2.0	mV
Input Offset Current	5.0	10	5.0	nA
Input Bias Current	40	80	55	nA
Input Resistance	5.0	2.0		MΩ
Large Signal Voltage Gain (R_L = 2kΩ)	300	200	100	V/mV
Output Voltage Swing (R_L= 2kΩ)	±13V	±13V	$\lvert+V_S - 1.2V\rvert$ to $-V_S$	V
Input Voltage Range	±14V	±13V	$\lvert+V_S - 1.5V\rvert$ to $-V_S$	V
Common Mode Rejection Ratio	100	90	85	dB
Power Supply Rejection Ratio	100	90	100	dB
Transient Response				
Rise Time	0.13	0.3		µS
Overshoot	5.0	5.0		%
Unity Gain Bandwidth	3.0	0.8	0.8	MHz
Slew Rate	1.0	0.5	0.5	V/µS
Input Noise Voltage Density (F= 1kHz)	10	22.5		nV/√Hz
Short Circuit Current	±45	±25		mA

Typical Performance Characteristics

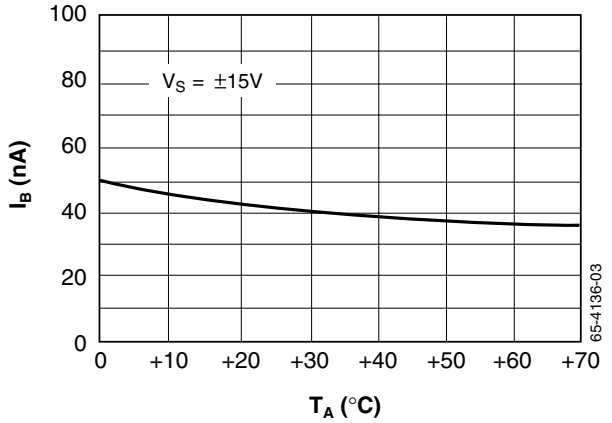


Figure 1. Input Bias Current vs. Temperature

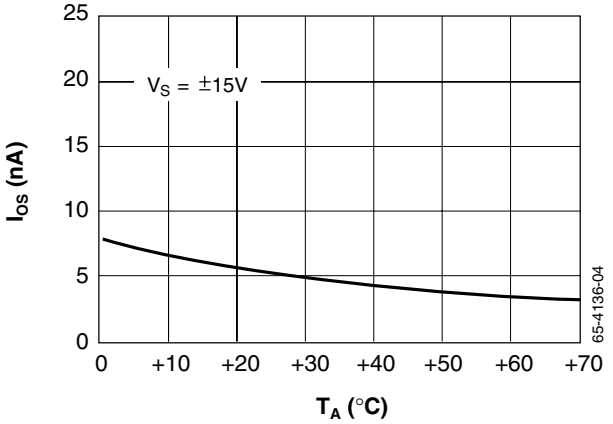


Figure 2. Input Offset Current vs. Temperature

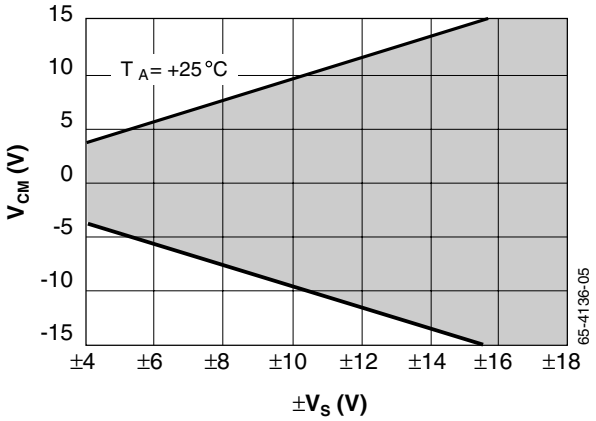


Figure 3. Input Common Mode Voltage Range vs. Supply Voltage

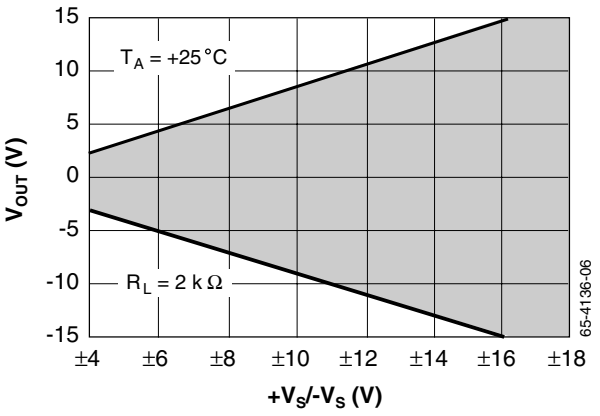


Figure 4. Output Voltage vs. Supply Voltage

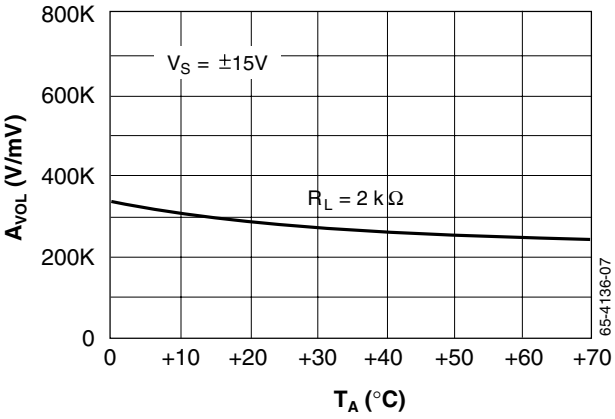


Figure 5. Open Loop Gain vs. Temperature

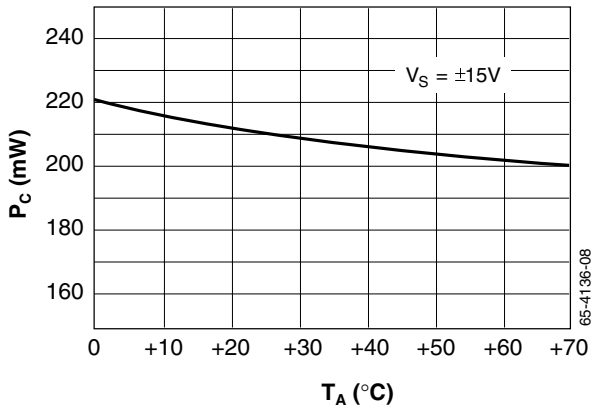


Figure 6. Power Consumption vs. Temperature

Typical Performance Characteristics (continued)

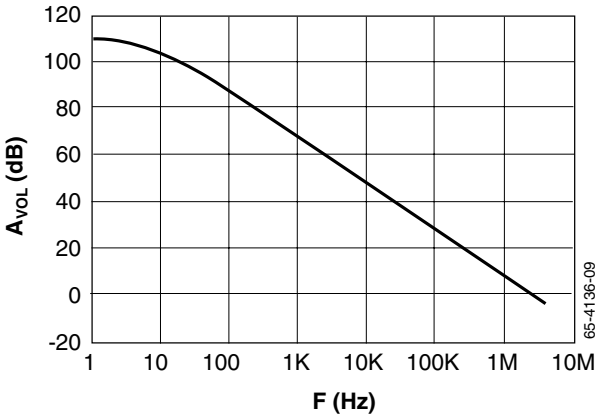


Figure 7. Open Loop Gain vs. Frequency

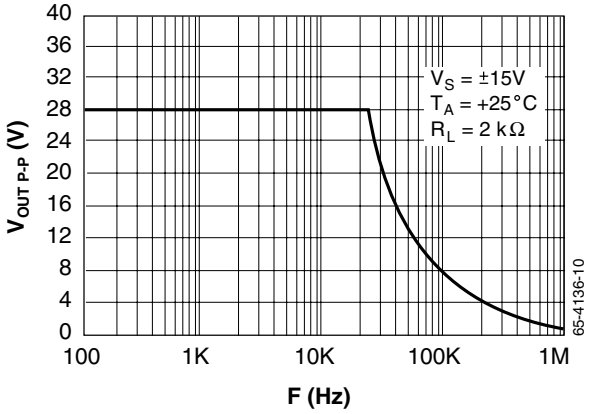


Figure 8. Output Voltage Swing vs. Frequency

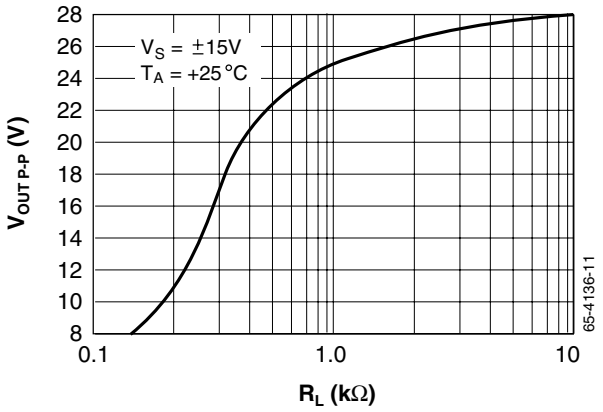


Figure 9. Output Voltage Swing vs. Load Resistance

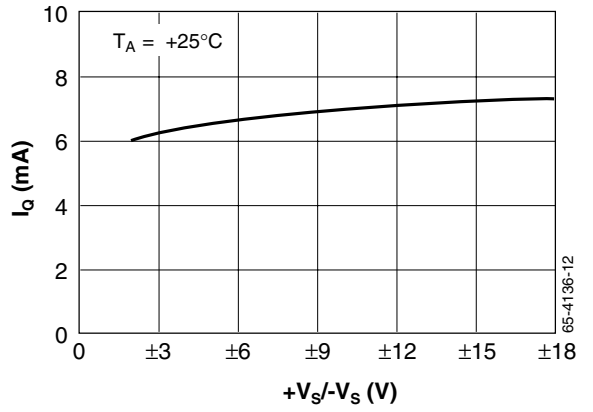


Figure 10. Quiescent Current vs. Supply Voltage

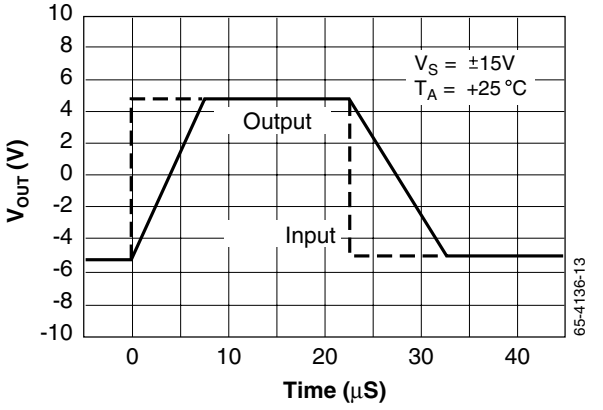


Figure 11. Follower Large Signal Pulse Response

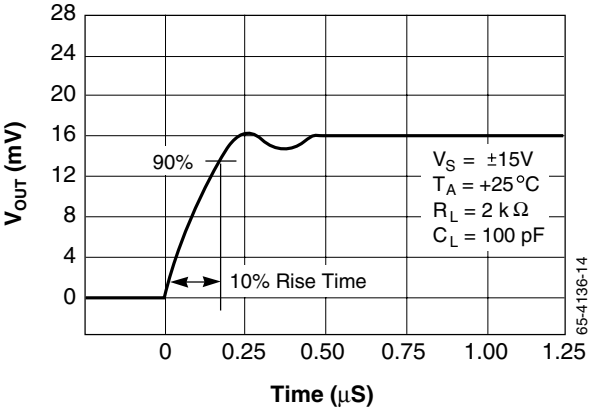


Figure 12. Transient Response Output Voltage vs. Time

Typical Performance Characteristics (continued)

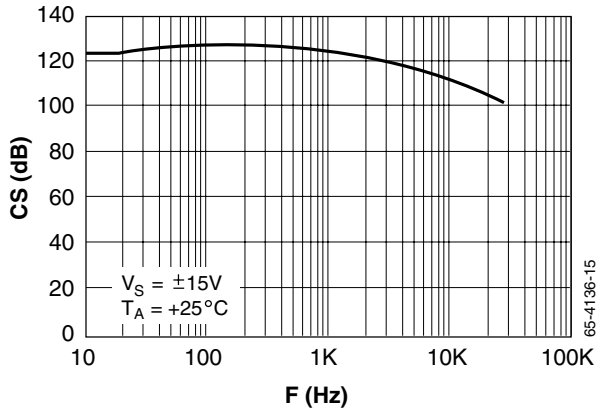


Figure 13. Channel Separation vs. Frequency

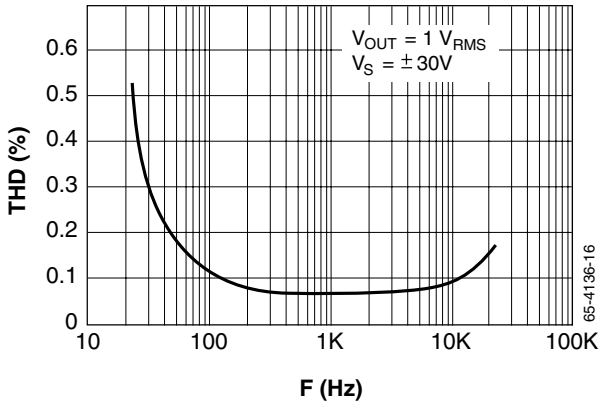


Figure 14. Total Harmonic Distortion vs. Frequency

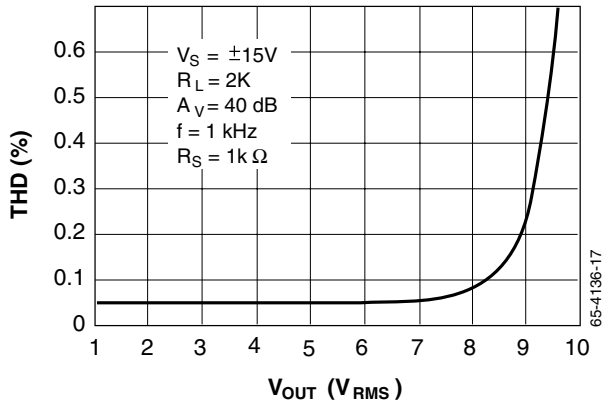


Figure 15. Total Harmonic Distortion vs. Output Voltage

RC4136 Versus LM324

Although the LM324 is an excellent device for single-supply applications where ground sensing is important, it is a poor substitute for four 741s in split supply circuits. The simplified input circuit of the RC4136 exhibits much lower noise than that of the LM324 and exhibits no crossover distortion as compared with the LM324 (see Figure 16). The LM324 shows significant crossover distortion and pulse delay in attempting to handle a large signal input pulse.

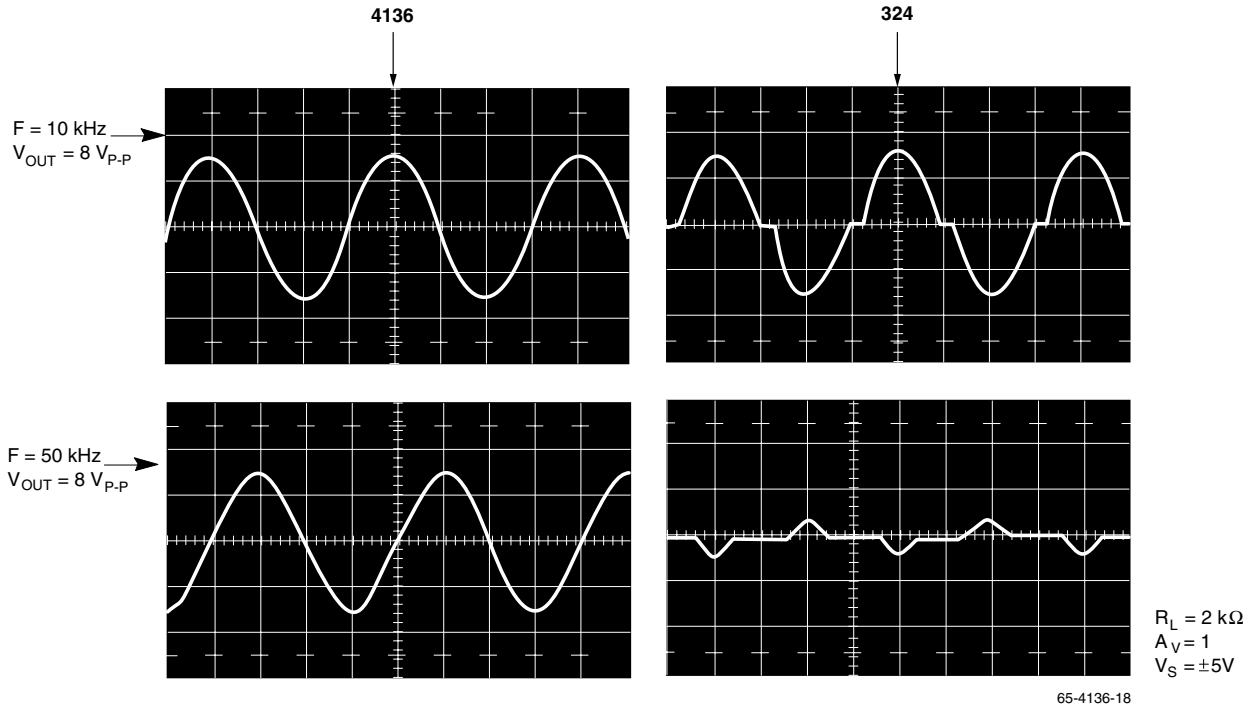


Figure 16. Comparative Crossover Distortion

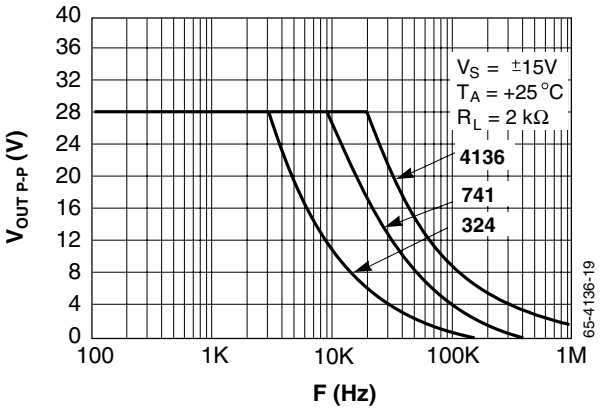


Figure 17. Output Voltage Swing vs. Frequency

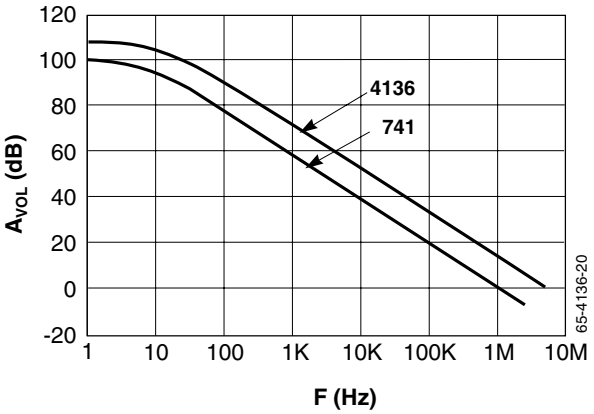


Figure 18. Open Loop Gain vs. Frequency

RC4136 Versus LM324 (continued)

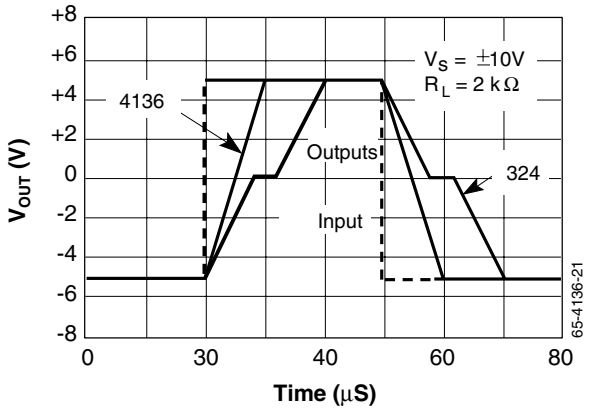


Figure 19. Follower Large Signal Pulse Response Output Voltage vs. Time

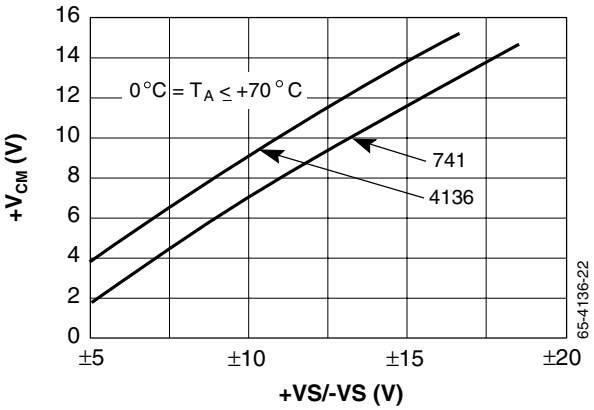


Figure 20. Input Common Mode Voltage Range vs. Supply Voltage

Typical Applications

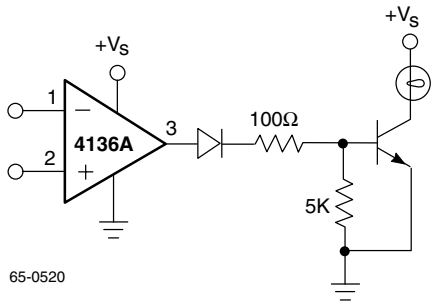


Figure 21. Lamp Driver

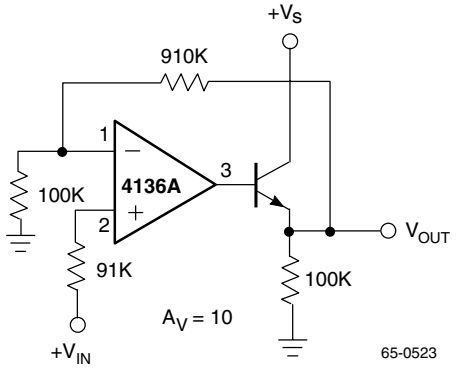


Figure 22. Power Amplifier

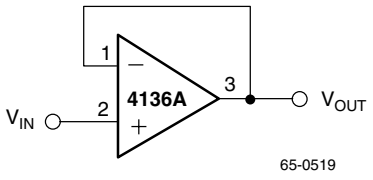


Figure 23. Voltage Follower

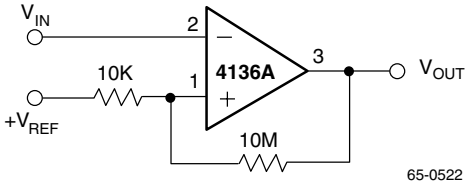


Figure 24. Comparator with Hysteresis

Typical Applications (continued)

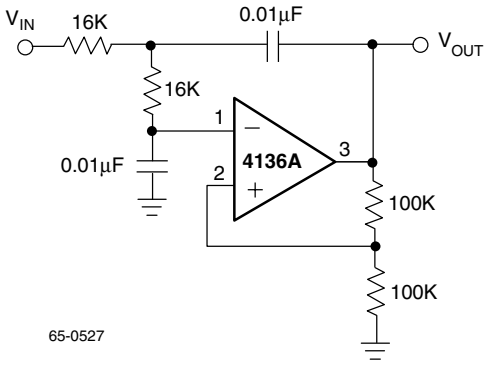


Figure 25. DC Coupled 1kHz Lowpass Active Filter

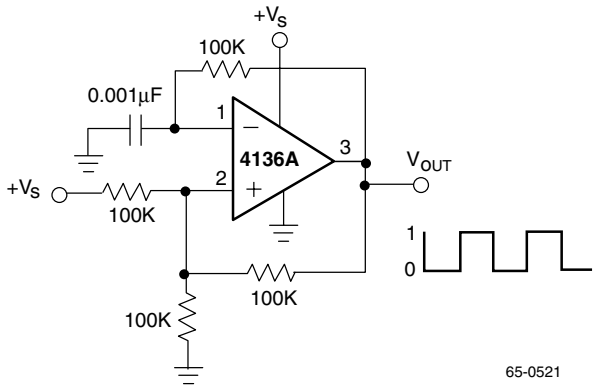


Figure 26. Squarewave Oscillator

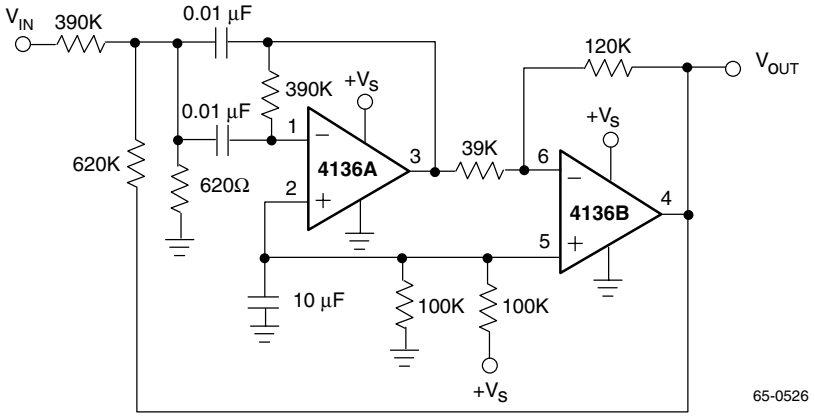


Figure 27. 1kHz Bandpass Active Filter

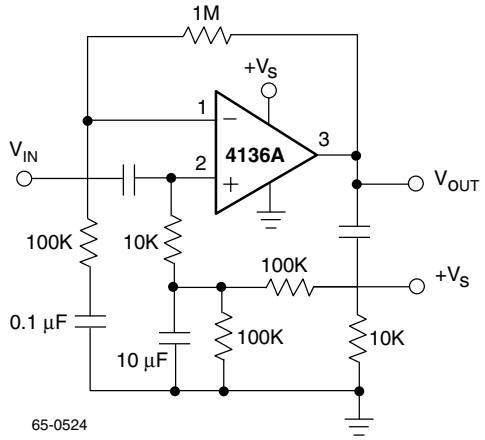


Figure 28. AC Coupled Non-Inverting Amplifier

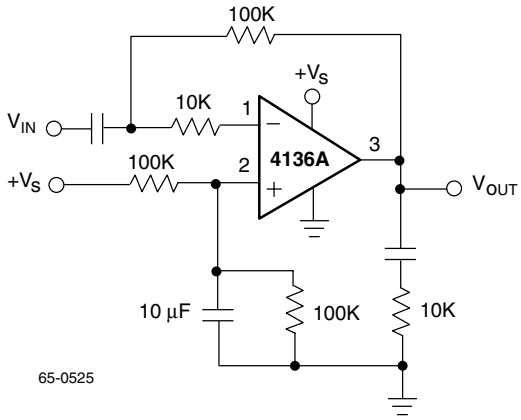
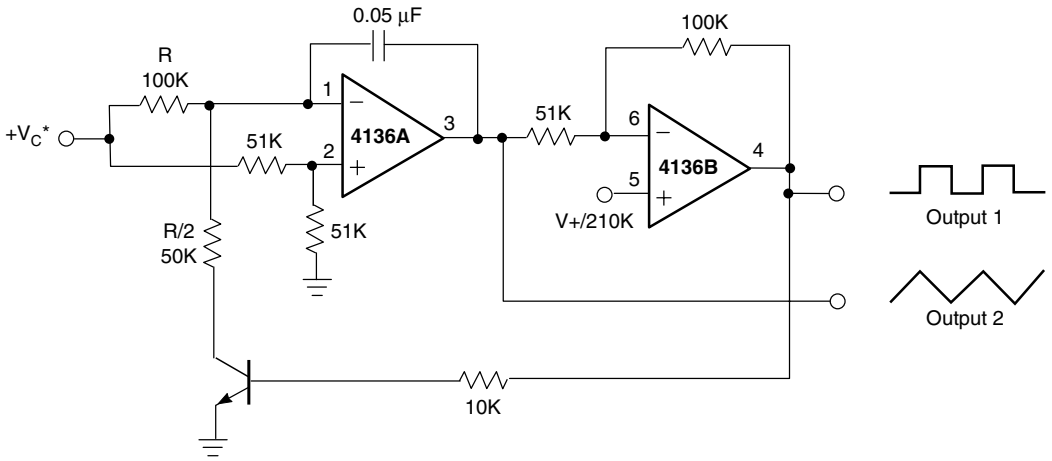


Figure 29. AC Coupled Inverting Amplifier

Typical Applications (continued)



* Wide control voltage range: $0V < V_C < 2(+V_S - 1.5V)$

Figure 30. Voltage Control Oscillator (VCO)

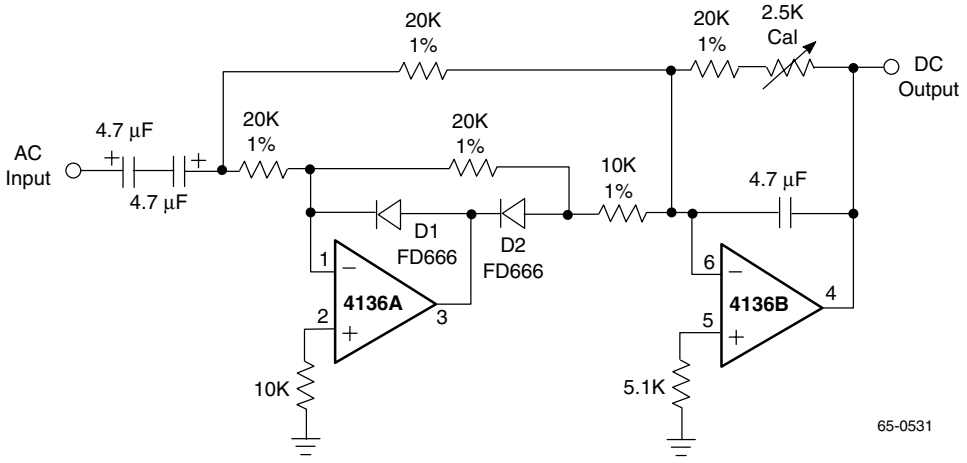


Figure 31. Full-Wave Rectifier and Averaging Filter

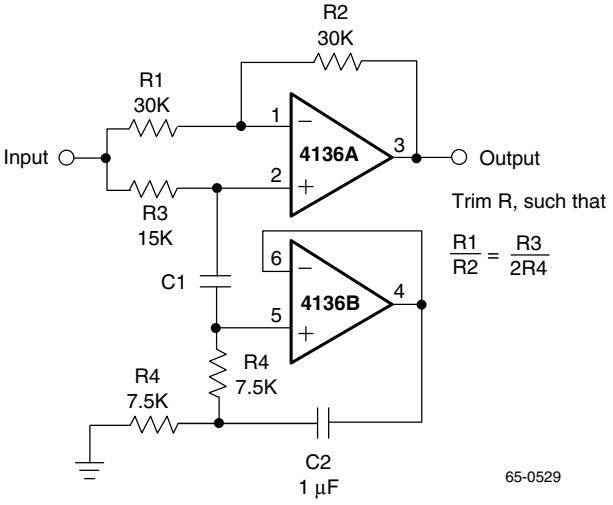


Figure 32. Notch Filter Using the RC4136 as a Gyrator

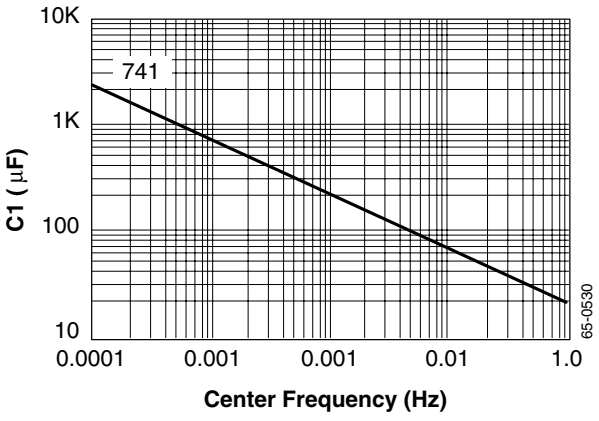


Figure 33. Notch Frequency vs. C1

Typical Applications (continued)

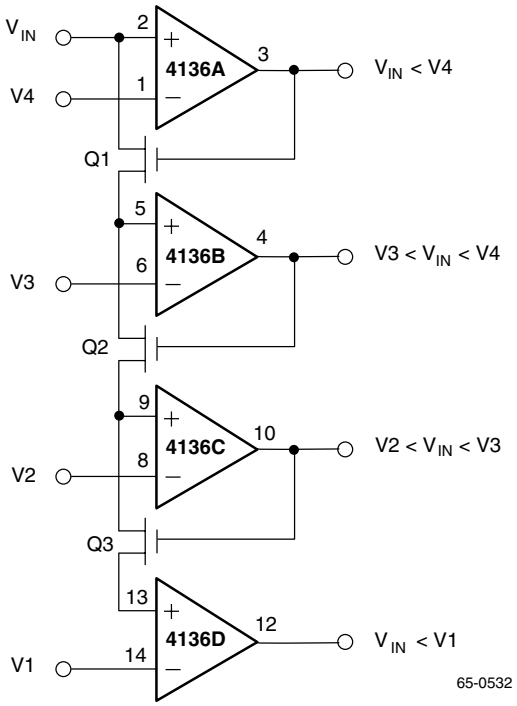


Figure 34. Multiple Aperture Window Discriminator

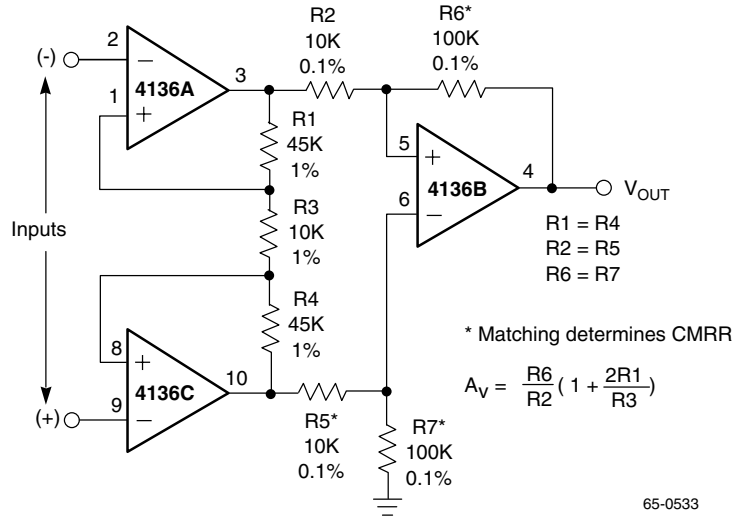


Figure 35. Differential Input Instrumentation Amplifier with High Common Mode Rejection

Typical Applications (continued)

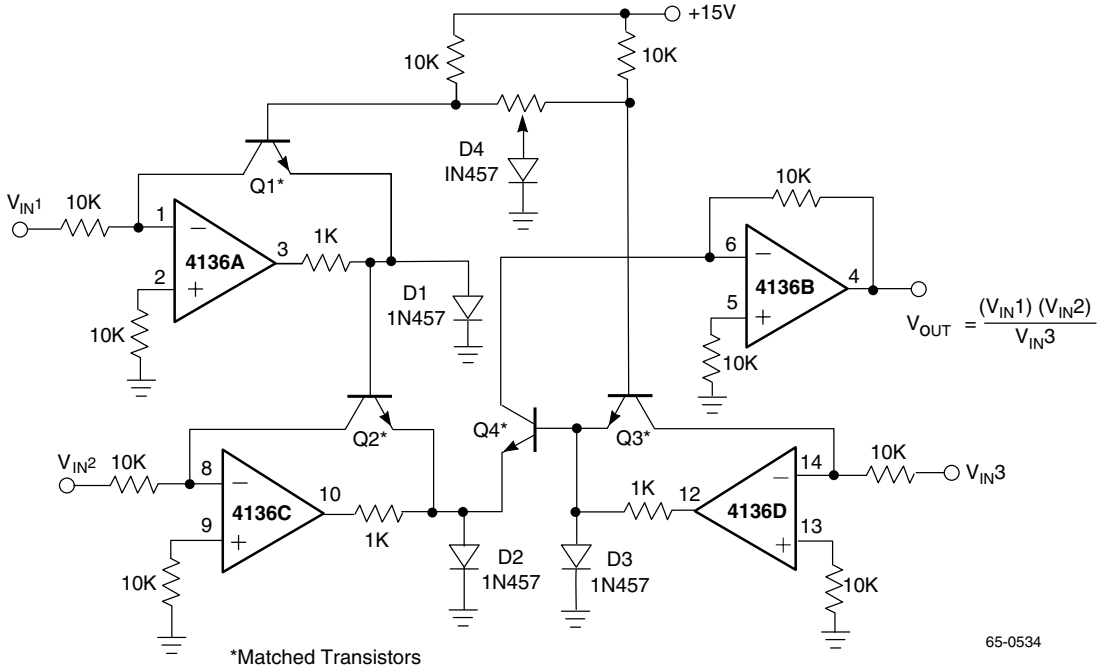


Figure 36. Analog Multiplier/Divider

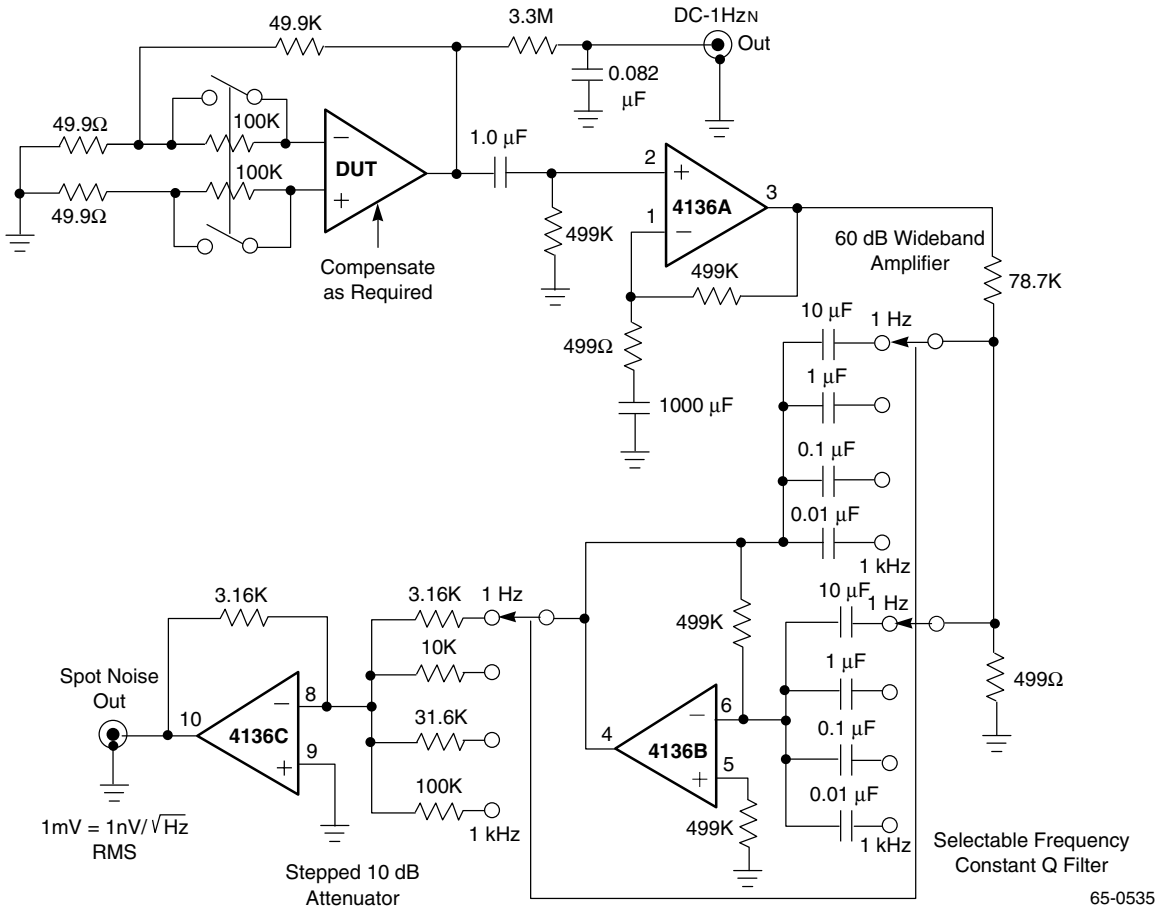
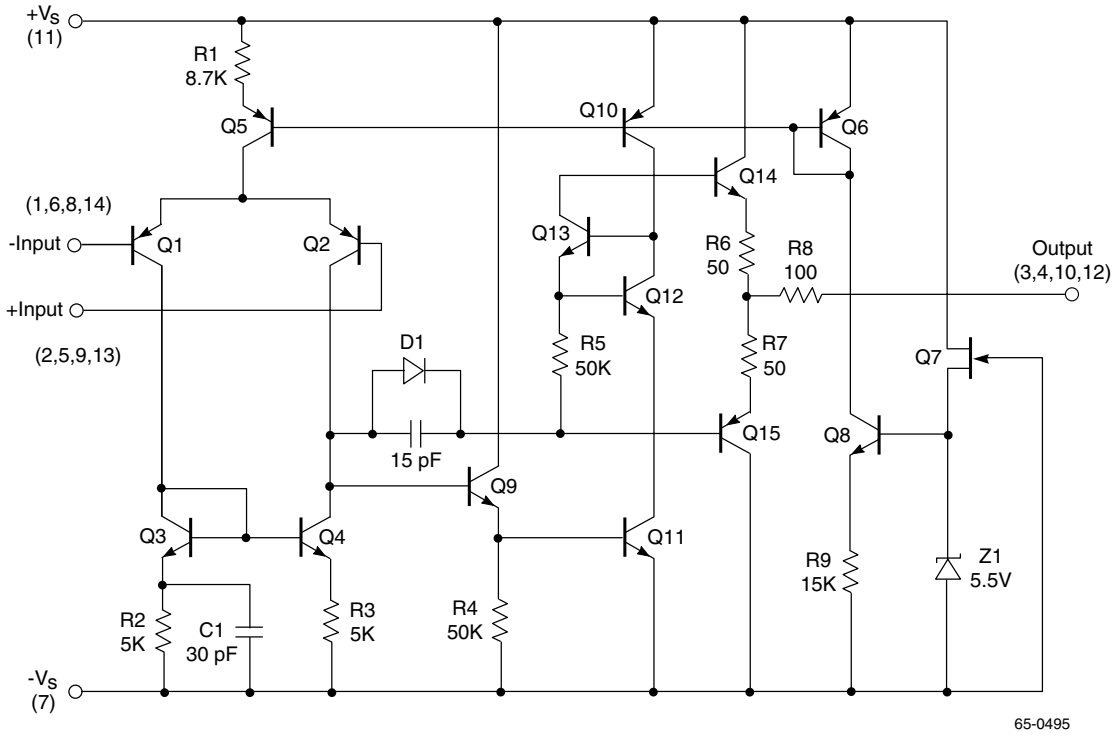


Figure 37. Spot Noise Measurement Test Circuit

Simplified Schematic Diagram



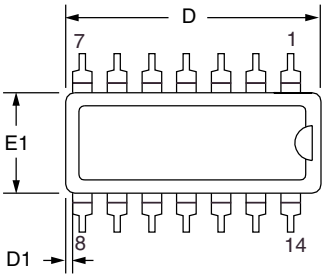
Mechanical Dimensions (continued)

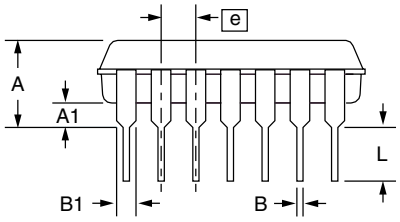
14-Lead Plastic DIP Package

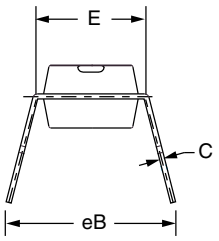
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.210	—	5.33	
A1	.015	—	.38	—	
A2	.115	.195	2.93	4.95	
B	.014	.022	.36	.56	
B1	.045	.070	1.14	1.78	
C	.008	.015	.20	.38	4
D	.725	.795	18.42	20.19	2
D1	.005	—	.13	—	
E	.300	.325	7.62	8.26	
E1	.240	.280	6.10	7.11	2
e	.100 BSC		2.54 BSC		
eB	—	.430	—	10.92	
L	.115	.200	2.92	5.08	
N	14		14		5

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E1" do not include mold flashing. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. Terminal numbers are shown for reference only.
4. "C" dimension does not include solder finish thickness.
5. Symbol "N" is the maximum number of terminals.







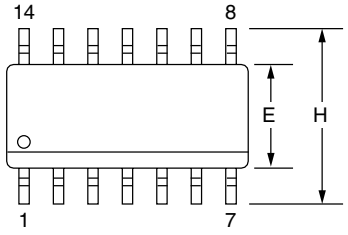
Mechanical Dimensions (continued)

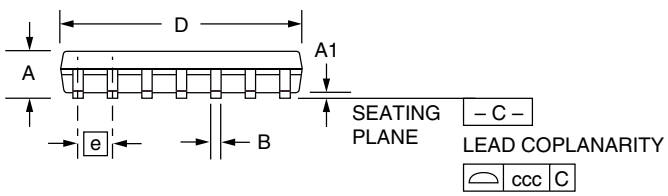
14-Lead SOIC Package

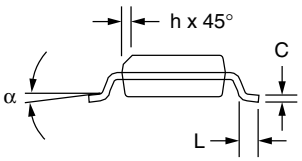
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	.053	.069	1.35	1.75	
A1	.004	.010	0.10	0.25	
B	.013	.020	0.33	0.51	
C	.008	.010	0.19	0.25	5
D	.336	.345	8.54	8.76	2
E	.150	.158	3.81	4.01	2
e	.050 BSC		1.27 BSC		
H	.228	.244	5.79	6.20	
h	.010	.020	0.25	0.50	
L	.016	.050	0.40	1.27	3
N	14		14		6
α	0°	8°	0°	8°	
ccc	—	.004	—	0.10	

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E" do not include mold flash. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. "L" is the length of terminal for soldering to a substrate.
4. Terminal numbers are shown for reference only.
5. "C" dimension does not include solder finish thickness.
6. Symbol "N" is the maximum number of terminals.







Ordering Information

Product Number	Temperature Range	Screening	Package	Package Marking
RC4136N	0° to 70°C	Commercial	14 Pin Plastic DIP	RC4136N
RC4136M	0° to 70°C	Commercial	14 Pin Narrow SOIC	RC4136M

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

6/14/01 0.0m 003
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